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INDUSTRIAL MODERNIZATION SURVEY GUIDE

This form has been designed by the editors of ELECTRICAL CONTRACTING for use in making industrial plant surveys preliminary to suggestions for alterations to, or the repair of the electrical wiring, lighting or equipment.

GENERAL WIRING CONDITIONS

ADEQUACY. How old is the wiring?..... Has the load been increased?..... Has the service been enlarged?....., The feeders?..... Have alterations been made permanent? ....., Or temporary?..... Is system overloaded?....., Are future additions planned?..... Have future loads been provided for?..... Is a plan of the present wiring available?.....

INSULATION. Has an insulation resistance test been made in accordance with Section 513 of the N. E. C.?..... Have any parts of the plant been damaged by fire?..... Which runs are subjected to: Seepage?..... Condensation traps?....., Oil accumulation?....., Excessive temperatures?....., Natural deterioration?.....

HEATING. Are lugs or terminals electrically secure?..... Are all buses and tap-off contacts: Clean?....., Securely clamped or bolted?....., In contact alignment?..... Are A.C. feeders free of inductive heating: In conduits?....., In metal ducts?..... In bus clamps?..... Are heavy resistors properly ventilated and isolated from massed conductors?.....

SAFETY. Are safeguards provided for protection against shocks from: Dangerous voltages?....., Live parts?....., Near grounded surfaces, machinery or piping systems?..... Are conduits, enclosures, control devices or supports guarded or located to minimize: Stumbling?....., Dangerous trip-out blows?....., Crushed hands or fingers?..... Are employees protected against: Accidental starting or over-running of machinery?....., Opening switches under load?....., Fuse blowout flashes?....., Explosions?.....

OVERLOAD PROTECTION. Are all feeders and circuits protected with automatic overload protective devices to correspond with N. E. C. capacity ratings?..... Have they been altered, bridged or otherwise tampered with?..... Are they plainly marked or labeled to permit quick and correct replacement?.....

MAKESHIFT WIRING. Are temporary wires to be replaced and made permanent?....., Or removed?.....Have alterations been properly designed to suit the main layout? .....

DAMPNESS. Does wiring in damp locations exclude moisture?.....Are conduits suitably drained?.....Are couplings and outlet connections leaded?.....Are devices designed for damp locations?.....Are gaskets intact?.....

CORROSIVE ACIDS AND GASES. Are copper surfaces coated to prevent corrosion?.....Have enclosures been designed to exclude injurious effects?.....

HAZARDOUS LOCATIONS. Are certain areas hazardous?....., Dust?....., Vapors?....., Lints?....., Liquids?..... Can electrical equipment be isolated from such exposeures?..... Are present devices designed for maximum protection in the specific location?.....

HEAT-FIRE RESISTANCE. Are high-temperature-area conductors holding up?.....Will maintenance economies result from asbestos insulation?.....

MECHANICAL INJURY. Are there loosened or damaged conduits, fittings and equipment?.....Can maintenance and interruptions be avoided by: Re-locating?....., Strapping? ....., Tightening?....., Recessing?....., Guarding? .....

GROUNDING. Are system, equipment and conduit grounds of Code capacity?....., Suitably protected against injury? .....Are resistance values at artificial grounds sufficiently low?.....Is static electricity generated?....., Correctly grounded?.....Are lightning arrestors intact?.....Are portable devices polarized and wired to ground plugs?.....

SERVICE AND DISTRIBUTION WIRING

SUBSTATIONS. Is present service primary or secondary voltage?.....Will private transformer station reduce power bills?.....Are isloated buildings more efficiently supplied by outlying transformer stations?.....Does present service provide lowest power cost?....., Continuous supply?....., Adequate capacity?....., Minimum hazard?.....

CONVERSION. If d.c. will a.c. changeover effect economies?.....If 220 volts a.c., will higher voltage changeover relieve present feeder overload and permit plant expansion?.....Can present isolated plant be replaced with purchased electric power to advantage?.....

POWER FACTOR. Is system overload due to low power factor?.....Can synchronous motors or capacitors be employed economically to correct this condition?.....

METERING. Are several plant units served and metered separately?.....Will common service and common metering reduce power costs and upkeep?.....Will department metering provide valuable operating data?.....

DEMAND CONTROL. Will demand recording and alarm devices permit power cost economies?.....

OFF-PEAK CONTROL. Are certain units operable only during off-peak hours?.....Can separate feeders be arranged for their sub-metering?.....

MAIN LIBRARY

SERVICE CLEARANCES. Is present service too low?....., Subject to accidental damage?....., Are overhead factory yard spans obstructing traffic?....., Do they interfere with firemen?....., Do they need re-wiring and new supports?..... Will new underground runs present shutdown?....., Reduce hazards?..... Are wall-bracketed runs interfering with yard operations?.....

FEEDER FLEXIBILITY. Are the plant machinery layouts changed often?.....Can wiring be provided readily?.....Do changes involve: Expensive feeder alterations?....., Dangerous temporary work?....., Expensive cutting or drilling?....., Capacity limitations?.....

LOAD CENTERS. Can feeders be re-distributed for minimum sub-fusing maintenance?.....Are load centers: Readily accessible for maintenance?....., Isolated from avoidable moisture?....., Fumes?....., Dust?....., Corrosion?....., Mechanical injury?.....

LOAD BALANCE. Are circuit connections evenly balanced on outer poles of 115/230 volt d.c.?....., 3-phase, 4-wire?.....Miscellaneous polyphase?.....

UNDERGROUND SYSTEMS. Are manholes and hand holes accessible for cable repairs and conductor replacement?.....Are walls and covers in good order?.....How about drainage?.....

MOTOR AND CONTROL WIRING

EFFICIENCY. Can largest motor be started satisfactorily when other motors are running?.....Are motors so wired that interruptions from excessive overloads interrupt other important motor operations?.....Can motor or control repairs be made safely without working "hot" group feeders?..... Can motors be re-arranged without expensive delays?....., Dangerous temporary work?..... Are portable motors operable without employing excessive lengths of cords?.....Will trolley feeder methods reduce time and interruptions?....., Cable reeling devices?.....

CONTROL. Are controls located for maximum saving in steps?....., For convenient control of mechanical devices (clutches, valves, levers, hopper gates, etc.)?.....Are additional starting, stopping or jogging stations advantageous?..... Are safety disconnects provided at out-of-sight motors?.....Are remote load-indicating ammeters needed?.....Are several motors inter-dependent?.....Will spoilage be avoided if electrically interlocked for: Sequence starting?....., Tripping?....., Group starting?..... Are controller locations upon permanent supports?....., Free of vibration?....., Isolated from injury?.....

ACCESSIBILITY. Do present wiring connections interfere with: Motor removal?....., Belt or chain adjustments?....., Switch or starter operatons?....., Resistor cleaning?....., Starter maintenance?.....

LIGHTING SYSTEM WIRING

WATTAGE PROVISIONS. Are feeders and circuits adequate for providing correct wattages throughout the plant?.....Is spare future capacity provided for?.....

OUTLET LOCATIONS. Have outlets been provided for: General distribution reflectors?....., Local units?....., High bay units?....., Watchman or cleaning lights?....., Yard lights?....., Pit lights?....., Gauges and indicators?....., Exits and stairs?....., Portables?....., Pilots?..... Are these outlets correctly located?.....

MAINTENANCE. Are lighting units: Accessible or adjustable for cleaning?....., Lamping?....., Guarded?....., Self-levelling?....., Vibration insulated?....., Theft protected?.....

CONTROL. Are outlets controlled from: Panelboard?....., Wall switches?....., Ceiling pull?....., At sockets?..... Are manual or remote-controlled master switches practical for large groups, with several control stations?....., 3-way switching....., 4-way?....., Lock switches?....., Indicating lamp annunciators?..... Are lights being wasted through lack of convenient controls?....., Lack of pilots?..... Are fire exits on seperate emergency throw-over controls?.....

WIRING DEVICES. Are switches capable of controlling lamps of high wattage inrush?.....How are plates insulated?.....Have heavy duty industrial type receptacles and plugs been installed?.....Do they provide grounding protection?..... Are sockets and switches loose, flickery or faulty?..... Are devices rugged enough to withstand abuse?.....

VOLTAGE. Are automatic regulating devices provided to protect against wide voltage variations?.....

WIRING FOR MISCELLANEOUS DEVICES

HEATING DEVICES. Are units wired for most efficient positions?....., For maximum portability?....., Will thermostatic control add to efficiency?....., Is device connected to most economical power source?.....

VENTILATION-AIR CONDITIONING. Are manual controls conveniently located?.....Are automatic or thermostatic controls located in the best position to provide uniform temperature?.....Are remote controls available at various affected areas, as well as at the fan or blower unit?..... How is breakdown of ventilating equipment for removing dangerous fumes or gases indicated to employees?.....

TRANSFORMERS. How are important transformer connections protected against general circuit failures?.....Are correct winding ratios being used?.....What overload protection is provided?.....

COMMUNICATION. Are telephone stations at most convenient locations?.....Have plant changes or increases introduced a need for added outlets?....., More flexible talking, ringing or flashing facilities?..... Are long runs adequately powered?.....Are chargers and batteries accessible?....., Suitably removed from injury?....., Dirt and corrosion?.....

SIGNALS—ALARMS. Are signals or alarms correctly located and planned to function efficiently for: Fire detection?....., Fire alarm?....., Burglar alarm?....., Material overflow, spillage or breakage?....., Machine overloads?....., Bin or hopper depletion?....., Track or conveyor clearance?....., Code calling?.....

ANNUNCIATORS. Are all vital departments included in the system?.....Will indicators increase plant efficiency by showing: Conveyor operations?....., Vault or store room occupancy?....., Oven use?....., "IN" and "OUT" recording?..... Are present locations satisfactory?.....Are resets arranged conveniently?.....Is most practical current supply being used?.....

ELECTRONIC DEVICES. Have "experimental" applications been made permanent?..... Are there other places where such control can be used?.....

HEAVY DUTY OUTLETS. Are separate outlets for operating heavy portable equipment adequately provided for?....., Polarized?....., Grounded?....., Separately wired from interference with other loads?....., Spaced to minimize excessive cord?.....

SERVICE AND DISTRIBUTION EQUIPMENT

TRANSFORMERS. Can power costs be reduced by: Wholesale rate transformer station?....., Additional transformers at remote plants?....., Replacement of overloaded transformer units?....., Low voltage portable tool and heater connections from power feeders?.....

SWITCHGEAR. Can maintenance costs be reduced, accidents prevented, or efficiency increased by replacing obsolete or inadequate oil breakers, arrestors, disconnects, potheads, insulators, enclosures, towers, etc.?.....

METERING AND REGULATION. Are power factor economies, feeder efficiencies and lower power costs possible through the use of: Capacitors?....., Voltage regulators?....., Net work protectors?....., Off-peak alarms?....., Demand meters?....., Recording instruments?....., Departmental metering equipment?.....

FEEDER AND CIRCUIT CONTROL. Does present distribution equipment provide: Maximum safety?....., Accurate overload protection?....., Convenient step-saving circuit control?....., Flexibility for adding additional load?....., Convertibility to changing circuit requirements?....., Ease of restoring interrupted circuits or feeders?....., Protection against moisture?....., Fumes?....., Explosive dusts?....., Gases?....., Corrosion?....., Mechanical injury?....., Tampering.....

FEEDER SYSTEMS. Are changes in machinery layouts more readily placed in operation by the use of bus-bar feeder distribution systems?.....Can portable machinery be more efficiently operated with trolley feeders equipment?....., By portable cables and reeling devices?.....

ROTATING MACHINERY

APPLICATION. Are operating economies, increased efficiency, or decreased hazards possible by applying modern motors or generators for: Present steam or gasoline direct drive?....., Isolated plants?....., Re-arrangement of group drives?....., Replacement of incorrect sizes?....., Types?....., More efficient voltages?....., Conversion from d.c. to a.c.?....., High cycle apparatus?....., Synchronous drives?....., The elimination of pulleys, belts and shafts through employing individual motors?..... Are present motors more cheaply replaced than reconditioned?.....

EFFICIENCY. Have accurate load tests been made of each drive?.....Are any motors overloaded?....., Underloaded?....., Unsuited for multi-speed operations?....., Starting torque?....., Reversing duty?....., High intermittent overloads?.....

PROTECTION. Are motors properly designed for protection against excessive temperatures?....., Moisture?....., Injurious dirt?....., Grit?....., Filings?....., Fumes?....., Corrosive acids?....., Oils?....., Explosive gas?....., Dust?....., Vapors?.....

DRIVES. Are motors more efficient if equipped with automatic belt tension devices?....., Variable speed attachments?....., Speed reduction?....., Space-reducing short centers?..... Are drives easily maintained?....., Removed?....., Quiet?....., Safe?.....

CONTROL APPARATUS

FUNCTIONS. Do present controls provide efficient, uninterrupted starting under all operating conditions?....., Correct speed control?....., Constant reduced speed running?....., Suitable acceleration?....., Reversing?.....

PROTECTION. Is the motor protected against overloads?....., Stalled rotor?....., Single phase operation?....., Voltage failure?....., Excessive voltage variation?....., Excessive speed?....., Grounded windings?.....

AUTOMATIC FEATURES. Is present control equipment suitable for the adaptation of improved control features such as interlocks?.....Limit switches?....., Magnetic brakes?....., Automatic reversing?....., Pressure?.....

SAFETY. Are present controls designed for: Protection against shocks and burns?....., For safe maintenance?....., Minimum arcing or flash-over hazard?....., Fuse blowing hazards?..... Should enclosures be explosion-proof?....., Dust-proof?....., Are valuable machines or products protected against over-running?....., Forcing?....., Overflow?....., Excessive friction?.....

DESIGN. Are manual controls satisfactory?.....Will magnetic or automatic types be more advantageous?.....Are quick-break contacts needed?.....Are safeguards against tampering needed?..... Should several controls be combined into panels?....., Switchboards?..... Is circuit breaker protection more economical than fuses?.....

LIGHTING

GENERAL SURVEY. Has each area been checked for its present lighting intensity?.....Has a survey been made showing the modern requirements in each area for: Intensity?....., General distribution?....., Local lighting?....., Glare-shadow elimination?....., Contrast?....., Reflection from bright metals?....., Color discrimination?.....

REFLECTORS. Is each outlet equipped with a reflector?.....Are present reflectors: Correctly shaped?....., Properly spaced?....., Supported?....., Lamp size?.....

LAMPS. Are present lamps suitable for normal plant voltage?....., Protected against vibration?....., Rough usage?....., Theft?....., Easily replaced?.....

HAZARDOUS LOCATIONS. Are present types suitable in hazardous areas?.....Are they close to flammable or combustible materials?.....

CORROSION. Is present equipment designed to resist steam?....., Moisture?....., Corrosive fumes?....., Acids?.....

SAFETY WARNINGS. Are exits, fire landings, warning pilots, or other special lighting units, designed for clear visibility?....., Correct coloring?....., Adequate illumination of turns, step-offs and safety ladders?.....

MISCELLANEOUS DEVICES

COMMUNICATION. Have plant expansions, new departments, or isolated office quarters outgrown present intercommunicating facilities?..... Are all departments interconnected?.....Does the system permit selective ringing?....., Talking?..... Are bells sufficiently loud in factory areas?..... Are code calls correct type?....., Will sirens penetrate new noisy areas?....., Are new stations necessary?..... Will public address be more practical?.....

SIGNALS AND ALARMS. Are production processes, machine operations, the use of special areas or lighting circuits kept more efficiently under supervision by lamp annunciators?....., Sirens?....., Bells?....., Fire detectors?....., Gongs?..... Are present devices of sufficient volume?....., Correct tone?....., Visibility?..... Does present equipment permit lowest insurance ratings?.....

SMALL HEATING DEVICES. Can fire and explosion hazards be reduced by the introduction of electrical heat? .....Do certain conditions require portability?.....Will electrical elements be more efficient because of: Their ability to be immersed?....., Automatic control?.....Reaching out-of-the-way points in machines?.....May space heaters be applied at isolated places?.....

TRANSFORMERS. Are present low voltage alarm and signal devices adequately powered?.....Is correct voltage available?.....Can batteries be dispensed with for transformers?.....Will air cooled transformers save power costs?.....

VENTILATORS. Are present facilities adequate for heating?....., Air conditioning?....., Drying rooms?....., Exhausts?..... Are dangerous dusts, fumes or gases expelled from all working areas?..... Are vents needed for motors?....., Sub-stations?..... Have shutters, louvers or dampers been provided?.....

PHOTO ELECTRIC CELLS. Can electronic devices be applied to replace mechanical or manual methods for production control?....., Grading?....., Sorting?....., Flow detection?....., Recording?....., Counting?....., Door opening?....., Or other applications?.....

STATIC-LIGHTNING ARRESTORS. Do any belts or machines develop sufficient static energy to require protection against material deflection?....., Shock hazard?....., Explosion hazard?....., Fire hazard?..... Are structures, tanks or contents in need of lightning protection? .....Is present equipment adequate?.....

EMERGENCY SYSTEM. Is an automatic emergency lighting system provided in case of current failures?.....

MAINTENANCE

PLANT SURVEY. Has all existing equipment been inspected for: Adequacy?....., Wear?....., Functional obsolescence?....., Safety?....., Fire hazard?.....

LOAD TESTS. Are accurate plant load records available? ....., Normal loads?....., Peak loads?....., Lighting load?....., Power load?....., Heating load?....., Departmental loads?....., Power factor?.....

SWITCHES. Are operating mechanisms in good order? ....., Contacts clean?....., In alignment?..... Is oil clean and ample?.....Are barriers and bushings intact? .....Are protective devices adjusted and calibrated correctly?.....Are encloseures tight?.....

SWITCHBOARDS AND PANELS. How old is the equipment?.....What flash-over or overheating damages exist? .....Are all movable parts easily operable?.....Are electrical contacts clean?.....Tight?.....Adequate?..... Are insulating bases broken?....., Correctly spaced?....., Free of leaks?..... Are conductors properly spaced?....., Tagged?..... Are all instruments and calibrations correct? ..... Is the equipment safe?....., Shielded?....., Properly enclosed?....., Readily accessible?..... Are circuits properly labelled?....., Indicated?....., Locked?.....

LIGHTING EQUIPMENT. Are reflectors, sockets, holders, receptacles and other fittings in need of repair?....., Cleaning?....., Replacement?.....Are cords, fixture wire and portable worn out?.....Are lamps blackened?.....

TRANSFORMER STATIONS. Are temperatures normal? ....., What is condition of transformer oil?....., Leads? ....., Potheads?....., Bus supports?....., Insulators? ....., Primary fuses?....., Disconnects?....., Arrestors? ....., Barriers?....., Ventilating equipment?....., Oil drainage ducts?....., Enclosures?....., Towers?....., Metering equipment?....., Operating levers?.....

MOTORS. Has load, speed and voltage been checked? .....Is winding insulation clean, dry, adequate and clear? .....Are all rotor parts intact, aligned, secure and functioning?.....Are armature parts and surfaces clean, ample, insulated, secure and in contact?.....Are brush areas, alignment, connections, tensions and materials correct?.....Are bearing surfaces, oiling devices, and lubricants correct and ample?..... Is alignment, end play, and rigidity maintained? .....Are leads, bushings, housings, connectors and markings intact?.....Are wearing surfaces in good order?.....

CONTROL APPARATUS. Are automatic overload devices operating correctly?....., At correct speed?....., Correctly calibrated?....., Is dash pot oil clean?....., Ample?..... Are phase failure, undervoltage, interlocks, reversing or accelerating devices in good condition?....., Correctly connected?....., Quiet in operation?..... Are all contacts clean?....., Of adequate copper?....., Free of flashovers?....., Firmly engaged?....., Well aligned? ....., Good flexible leads and pigtails?..... Are all covers, guards, lookouts and pilots kept in good order?....., Are additional safeguards needed?..... Have resistors become dustladen?....., Broken?....., Confined?....., Loosened? ....., Are guards needed?..... Can variable speed control be maintained for desired periods?..... Are isolated auxiliary controls employed in addition to starter?.....

BATTERIES. Are batteries capable of maximum emergency loads?.....Is insulation dependable?.....Are plates in good order?.....How does charger operate?.....Are battery trays OK?.....Is wiring safe?.....Has corrosion been checked?.....Are control relays and instruments properly connected and calibrated?.....

VENTILATORS. Are blades, fins and shafts true?..... Are shutters operating?.....Is noise minimized?.....Are ducts tight?....., Clean?.....

HEATING DEVICES. Are elements operating efficiently? .....Are elements, contacts and terminals free of foreign matter?....., Corrosion?....., Grounds?....., Vibration? ..... Are switches correctly connected?....., Adequate size?..... Do frayed cords, broken beads, wedges and bushings need replacing?.....

TRANSFORMERS. Are correct winding ratios in use? .....Are insulation, mountings, terminal supports, leads and enclosures in need of repair?.....

AUXILIARY DEVICES. Are contacts, spring tension, latch engagement, resistors, bases, and mechanical parts of bells, gongs, flashers, contactors, relays, magnetic brakes, timing devices, solenoids in good working order?.....

CRANES, HOISTS, TROLLEYS. Are spans supported safely?.....Are strain and bracket insulators cracked or grounded?.....Are conductors kinked or patched?..... Have such spots been weakened, excessively worn, blistered? .....Are cab controllers, trolley shoes, relays, instruments, local heating devices in good order?.....